AIR COMMAND AND STAFF COLLEGE

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AIR UNIVERSITY

UNDERGRADUATE AIR BATTLE MANAGER TRAINING: PREPARED TO ACHIEVE COMBAT MISSION READY

by

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ABSTRACT

The significant decrease of live training opportunities for Undergraduate Air Battle Manager Training students along with a slight increase in simulation training opportunities has left graduates of the 2013 Undergraduate Air Battle Manager Training syllabus behind their predecessors This impact has been felt in current conflicts and will only increase in future warfare if an acceptable mixture of live and simulation training is not achieved.

INTRODUCTION

Overview of the Study

In an era of fiscally constrained budgets the Department of Defense (DOD) acquires fewer aircraft and flies those aircraft for less amounts of time; this acquisition strategy leads to less training sorties available to train Air Battle Mangers. To counteract fewer sorties available for training the DOD has heavily invested in simulations, simulators, and Distributed Mission Operations (DMO) capabilities throughout Air Combat Command (ACC) and Air Education Training Command (AETC). In a speech at the Close Air Support Summit, Air Force Chief of Staff General Mark Welsh "…the Air Force plans to rely heavily on virtual environments, simulators and other tools, as it trains pilots to combat fifth generation threats, such as the aircraft China and Russia are producing…new aircraft can change things so rapidly that it doesn't make sense to try and replicate them in an aircraft when it can be done rapidly and relatively inexpensively in a simulator." [i]

While specifically speaking to pilot training, this quote could easily be applied Undergraduate Air Battle Manager Training (UABMT) conducted at Tyndall Air Force Base (AFB), Florida. From 1996 to today the syllabus requirement to control aircraft using live radar, radios, and aircraft has decreased from 239 hours[ii] to 39.5[iii] for an 84% reduction. A corresponding decrease in combat capability has been observed, both in combat and in complex training scenarios, by those who are responsible for employing Air Battle Mangers in combat at the E-3B/C/G Airborne Warning and Control System (AWACS), the E-8C Joint Surveillance Targeting Attack Reconnaissance System (JSTARS), and the Control and Reporting Center (CRC). This study will seek to examine the link between decreasing live

training opportunities and a correlation between decreased combat capabilities. As the complexity of future air warfare, continues to grow ABMs will be required to integrate effects across Air, Space, and Cyberspace. The opportunity to train with those effects in a live, non-pristine, environment is of paramount importance to the USAF's ability to dominate those three domains.

The Nature of the Problem

Researching UABMT syllabi back to 1996 shows that the bulk of training, 239 of 649 syllabus hours[iv], was accomplished using live fighter activity. The existence of three F-15C fighter squadrons at Tyndall AFB, allowed for the syllabus to focus primarily on live control due to the abundance of opportunities. As those fighter squadrons were deactivated and all F-15C pilot training moved to the Air National Guard (ANG) those live control opportunities decreased. Currently, the 337th Air Control Squadron (ACS) has ready access to two F-22 squadrons but must share those local control events with the 81st Range Control Squadron (RCS). The RCS historically would achieve enough control events through large exercises such as COMBAT ARCHER but there are less of those events due to decreasing funds. Therefore, the RCS must control events outside of their chartered Weapons System Evaluation Programs (WSEP) events. As there were less fighter squadrons, the 337th ACS was forced into using simulation or simply removing requirements to cover fighter gaps.

As a result of the fighter squadron drawdown, from 134 during the first Gulf War, to the current number of 54 the Air Force increased funding to simulation and DMO. The 337th ACS does not currently have access to the larger Distributed Missions Operations Network (DMON) however does have access to a local "DMO-lite" capability that links the four F-15C Full Motion Trainers (FMTs) to the 337 ACS. These FMTs comprise the largest "event"

category, with 13, in the UABMT syllabus and form the basis of air-to-air control events for UABMT students. Connecting to the DMON network requires a cross-domain solution that is available but will not be acquired for several years.

The 337th ACS does have access to a simulator capability that is used for the air to ground and large force employment (LFE) blocks. The instructor cadres, based on real world experience, create large force employment scenarios. For example, as Operation IRAQI FREEDOM drew to a close and Operation ENDURING FREEDOM became the primary mission set the air to ground simulation evolved to replicate operations in Afghanistan and Iraq. The simulation drivers are "pilot simulators (PS)" who range from Airman Basic (AB) to Senior Airman (SrA) who hold the 1C5 Air Force Specialty Code (AFSC). The 1C5X1 is trained to:

> "Operate aerospace control and warning systems equipment. Interprets and reacts to RADAR scope presentations and to generated console displays. Compares and reports track positions based on flight data or data base files. Performs surveillance, identification, weapons control, data link, and data management functions. Conducts mission planning. Prepares and executes air tasking orders and airspace control orders. Participates as a crewmember of an operational unit. Responsible for safety of flight for air operations being controlled. Tears down, loads, unloads, and erects equipment and components."[v]

Nowhere in the above training description are 1C5X1s trained to be "pilot simulators and therefore require extensive scripts to ensure desired learning objectives are being met for each scenario. Additionally, a script is required so UABMT students receive a consistent experience regardless of which round of simulations they take part in. Regardless of the quality of the script all student inputs can not be accounted for and a brand new 1C5 will not sound like or react like a "real" pilot. Due to this simulation training develops "simisms" where instructors must explain an unrealistic scenario driven by an incorrect PS input.

These simulation scripts are only as good as the authors experience and typically present the scenarios in a time compressed, to ensure adequate student brief and debrief time, and "pristine" environment. There is very little system degradation for example: radio failure, radar failure, communications jamming, and radar jamming to emulate what happens when using live equipment against live adversaries. Additionally, the simulations are not long enough to allow mistakes to compound. For example, sending an aircraft to an unscheduled tanker in theater may result in that tanker being short on fuel for receivers three hours from now but the student never sees that effect due to a simulation duration of one hour. Therefore, the UABMT students must learn to deal with those issues later in their career and often on live combat sorties.

The final issue is a lack of clarity on what does an ABM does? The heavy emphasis on fighter control in the 1996 syllabus (656 of 1280 syllabus hours[vi]) shows that ABMs were closer to their 1C5D (enlisted controllers) than true "battle managers." They were expected to provide an air picture, assist fighters in targeting, and provide threat calls to untargeted groups. These responsibilities existed because fighter sensors had limited range and there was no good way to digitally share information. Through the evolution a fighter's active and passive sensors and datalinks, specifically Link 16, the ABM has been largely freed to focus on other responsibilities such as tanker fuel management, data link employment, force allocation, and non-kinetic integration. The problem with using only simulators to train ABMs is that they are not prepared for the tasks they are expected to do in current, or future, theaters of operation.

Purpose of the Study

The purpose of this study is to evaluate as to whether an ABM can adequately be trained for combat missions through the use of simulator only training. An evaluation of current syllabi, through the lens of current operations, will provide insight as to effectiveness of current simulations. Through study of past syllabi and interviews with current and former Squadron Weapons Officers, a 2025 UABMT syllabus will be presented focusing on tomorrow's threats and capabilities. This solution will include live, virtual, and constructive training events focused on preparing battle mangers for the full spectrum of operations in contested, degraded, and operationally limited environment.

Research Methodology

This paper will perform a qualitative evaluation of the problem/solution framework of using only simulators to train UABMT students. This paper will provide the reader an analysis of historical and current UABMT syllabi to provide perspective as to what graduates of the course bring to combat operations employing on AWACS, JSTARS, or in the CRC. By understanding this perspective the reader will gain an appreciation for the shortfalls of moving towards more simulator and less live training opportunities. Finally, the reader will be provided a solution in the form of an ABM syllabus of the future that mixes live and simulated training to achieve maximum combat effectiveness in a contested, degraded, or operationally limited environment.

The Research Question

Combatant Commander's expectation of "battle managers" continues to increase, especially in a contested, degraded, or operationally constrained environment where integration of effects is critical for continued success. The body of research on effectiveness

to certify commercial pilots in simulators exists, however similar research does not exist for Air Battle Managers. The use of simulators as part task trainers is effective yet they are only as good as their script which in an environment of literally 1000's of moving parts can not be scripted. Therefore, the research questions is; what is the correct mixture of simulator and live training to prepare ABMs for mission ready status?

Literature Review

Civilian Training of Civilian Pilots

Little has been written on the effectiveness of using simulators to train ABMs for combat, however there has been some publication on the effectiveness of training civilian flight crew, engineers and navigators, as well running civilian flight schools. Title 14, Chapter I, Subchapter H, Part 61, 141, and 142 deal with the federal requirements of running a flight training center and training civilian pilots. Part 141 details that, even with the most advanced simulators simulator training "cannot exceed 50% of the total flight training hour requirement."[vii]

Navigators and Engineers

Title 14, Chapter I, Subchapter D, Part 63 deals with the certification of flight crewmembers other than pilots, and specifically refers to navigators and engineers. With respect to aeronautical experience to certify a flight engineer "except as otherwise specified therein, the flight time used to satisfy the aeronautical experience requirements my have been obtained on an airplane"[viii] Later, in the same section requirements for flight navigators are "at least 200 hours of satisfactory flight navigation including celestial and radio navigation and dead reckoning."[ix] In these instances, the Federal Government has deemed there is a requirement to train aircrew using live flight and not just simulators.

Air Traffic Controllers

While air battle management is not Air Traffic Control (ATC) duty, nor is an ABM ever certified as an ATC controller during the course of normal career progression, there are certain parallels. Federal Regulations Code, specifically Title 14 Part 65, deals with the training of air traffic control tower operators. Specifically, "each applicant for air traffic control tower operator certificate must pass a written test on the flight rules in part 91 of this chapter, airport traffic control procedures, en route traffic control procedures, communications operating procedures, flight assistance service, air navigation, aids to air navigation, and aviation weather"[x] Additionally, "no person may act as an air traffic control tower operator, at any operating position, unless he has passed a practical test."[xi] The practical test will cover "control tower equipment, weather reporting procedures, Notices to Airman, use of Airman's Information Manual, use of operational forums, performance of non-control operational duties, airport rules, terrain features and visual checkpoints for each class of airspace, operational agreements, traffic patters, search and rescue procedures, holding procedures, radar alignment, and terminal air traffic control procedures. Furthermore, "each applicant for a facility rating at any air traffic control tower must have satisfactorily served for at least 6 months if a member of the United States Armed Force." [xii] Finally, with respect to currency requirements "the holder of a an air traffic control tower certificate may not perform any duties under that certificate unless he has served at least three of the preceding six months as an operator at the control tower …"[xiii]

Pilots

Fred George, of Business and Commercial Aviation Magazine, argues that "simulator training has long been recognized as essential to safety of flight…but simulator training

alone does not guarantee you have all the knowledge and skills to be truly safe in the cockpit."[xiv] Additionally, Mr George goes on to say that

> "Most simulator training involves controlling the aircraft relatively close to the ground, in the vicinity of certain airports, during approach, landing, takeoff and initial departure. While upset recognition and recovery exercises are included in most syllabi, loss-of-control mishaps, particularly ones that occur at high altitude, continue to be problematic. Loss-of-control events indeed have overtaken controlled flight into terrain as the leading cause of fatal accidents in transport category aircraft. The National Traffic Safety Board (NTSB) in recent years has urged the Federal Aviation Administration (FAA) to require upset training for air transport pilots. Accident analyses indicate that stalls, ice contamination, wake turbulence and spatial disorientation, along with flight control malfunctions, are leading causes of fatal accidents."[xv]

Previous to this articles publication the FAA increased the number of hours pilots seeking instrument rating could log in a simulator by 20 hours or 40%[xvi] This policy change was published in January 2014 and by January 2015 the rule was rescinded due to "raised concerns regarding the effectiveness of ATDs for training, suggesting that these devices do not provide appropriate sensory cues or a realistic environment. Another comment, this one anonymous, expressed an opinion that the increases in time/percentage of training contained in the direct final rule were too great, even though they were only being raised to a level that had been established as appropriate through the prior policy."[xvii] The Aircraft Owners and Pilots Association (AOPA) quickly responded with "The adverse comments are demonstrably inconsistent with significant and longstanding experience that has established as fact the economic, environmental, and safety value of allowing a max of 20 hours of time in an approved ATD counting toward requirements for an instrument rating."[xviii]

Most literature deals with using simulators to train civilian aircrew and most of the literature sheds a positive light on using simulators. However, the FAA and other bodies have

recognized that using only simulators or increasing percentages can have adverse affects. This will directly contrast with the evolution of the ABM syllabus from 1996 to 2013.

Using Distributed Mission Operations to Train Air Battle Managers

Finally, an article published by then Captain Shaun Humphrey entitled *Utilizing DMO for E-3 Major Theater War Spin-Up* identifies issues with the current simulation capability to train ABMs. "Contractors 'drive' and provide voice communications for approximately 20 assets during the simulation. The remainder of the assets are on 'tape,' meaning they need no input from contractors to complete their assigned task after creation…the problem with this type of simulation is that it's very scripted, not dynamic, and therefore not very realistic."[xix] Captain Humphrey then goes on to describe how using a combination of Distributed Training Operations Center (DTOC) and Distributed Missions Operation Center (DMOC) could be used to achieve a higher quality "simulation" using DMOC/DTOC. It is important to note the distinction between DMOC/DTOC and simulation. DMO links Combat Air Forces (CAF) pilots, Weapons System Operators (WSOs), and their simulators together. DTOC personnel are current or formerly qualified pilots, and have a better understanding of current blue tactics, techniques, and procedures. Pilot Simulators or contract simulation drivers are likely not pilots, and have never employed the weapons system they are simulating; this leads to "simisms" where the tactics and communications displayed for the ABM are not representative of what a real entity would do in combat.

Background: Battle Manager Syllabus (1996)

The national security environment was significantly different in 1996 than it is in 2016. The First Gulf War had successfully concluded and Operation NORTHERN WATCH and SOUTHERN WATCH were in full effect enforcing a "no-fly" zone over northern and

southern Iraq. In addition, North American Air Defense (NORAD) was focused on the defense of the North American continent from an external symmetric threat. Fighter aircraft had limited organic sensor capabilities and Link 16 was just being implemented on non-C2 assets. [xx] The ABM career field was three years from producing graduates who would serve as "rated" officers. The expectation of graduates were that they would be expert "controllers" of fighter aircraft similar to their enlisted counterparts, Weapons Directors (WD), with the AFSC 1C5D. The difference between a WD and ABM was that ABMs were expected to move into supervisory positions at AWACS, JSTARS, ADS, or CRC whereas the WDs would stay aircraft controllers for the large majority of their career. Supervisory positions included Senior Directors (SD), who is responsible for supervision the Weapons Section, which included WDs and ABMs. Air Surveillance Officers, who are responsible for supervising the Surveillance and ID section, which included Air Surveillance Technicians (ASTs) with the AFSC 1A4. Weapons, Surveillance, and ID are sections that are common amongst all of the ABM platforms, although the individual crew positions may have different names. "Rated" means that the officers receive flight pay and must actively fly a certain amount of time in order to continue to receive flight pay. The lack of "rated" officership is significant because later syllabi would devote more time to "airmanship" fundamentals e.g. flight related duties such as aviation fundamentals, checklist adherence, and aviation principles. Finally, ABMs who graduated the 1996 *Battle Manager Syllabus* were awarded an ABM "badge" instead of wings and would receive their wings at follow on flying assignments with AWACS, or later, JSTARS.

This environment drove the 142 day 1996 *Battle Manager Syllabus* to focus heavily on the missions that were required of its graduates: surveillance and air-to-air weapons

control. The bulk of the graduates from the 1996 *Battle Manager Syllabus* would go on to serve in the air defense sectors (ADS), AWACS, Airborne Battlefield Command and Control Center (ABCCC) or CRC units. For example, 232 of 1,280[xxi] syllabus hours were devoted to Air Surveillance Systems and Procedures with another 199 hours devoted Peacetime Intercept Procedures; the total hours (431/1,280) accounts for 34% of the syllabus hours. JSTARS, with a focus on air-to-ground control, only had two developmental aircraft, which participated in Operation DESERT STORM in 1991 and Operation JOINT ENDEVOR in 1995, but had not declared initial operating capability (IOC) until December 1997. There was little emphasis on air-to-ground, procedural control, or other large force employment concepts. Being stationed at Tyndall AFB, FL provided easy access to air-to-air training missions "through a medium of live weapons directing practice with MU-2 and F-15C aircraft."[xxii] The MU-2 aircraft is a high wing, turbo-prop aircraft that was used to provide air-to-air training at a slower rate of closure than high performance aircraft such as the F-15C. The pilots were all contractors who were trained to emulate a fighter timeline and provide responses to controller communications in accordance with standards.

The 1996 *Battle Manager Syllabus* used simulations primarily to teach the most basic and advanced air-to-air control concepts. Basic air-to-air concepts included 1v1 cutoff and stern attacks (234 hours), simulated controller directed aerial refueling (34 hours), and tactical control procedures (63 hours). The advanced simulations included defensive counter air (62 hours), offensive counter air (48 hours) and a large force employment exercise (63 hours). Due to the nature, air-to-air only, of the F-15C training units defensive counter air could be accomplished using live assets but offensive counter air and large force exercises had to be completed using simulations.

Background: Undergraduate Air Battle Manager Syllabus (2013)

ABM graduates of the 2013 syllabus enter a drastically different operational expectation than their 1996 syllabus predecessors. Operation FREEDOM'S SENTINEL, or the successor to Operation ENDURING FREEDOM, and Operation INHERENT RESOLVE are the current conflicts. Combatant Commander requirements from Command and Control (C2) platforms, and by extension ABMs, requires more than just making a "threat call" at the appropriate time. It requires individuals to internalize commanders "intent" and execute within the fog and friction of warfare. This is very different than basic controller skills and concepts associated with weapons directors.

Additionally, "President Obama's ninth trip to Asia and the Pacific in November 2015 reflects the growing importance of the region to U.S. national interests and the Administration's commitment to advancing our broader regional strategy, known as the Rebalance."[xxiii] Through these two operations, and the larger national security strategy, graduates of the 2013 *Undergraduate Air Battle Manager Syllabus* must be prepared for current and future warfare. Current and future combat skills required of graduates are air-to-air control, air-to-ground control, dynamic digital and voice communications management, among many others. Graduates of the 2013 *Undergraduate Air Battle Manager Syllabus* are "rated" officers and were also awarded their "wings" upon graduation. This is significant change from the 1996 *Battle Manager Syllabus* because a larger portion of the course must provide training to ensure ABMs develop basic airmanship similar to graduates from Undergraduate Pilot Training (UPT) or Undergraduate Combat Systems Officer Training (UCSOT), formerly known as Undergraduate Navigator Training (UNT).

This environment drove the 2013 *Undergraduate Air Battle Manager Syllabus* to focus on many different aspects of warfare. Of note, the syllabus increased to 170 days, or 1,529 hours, due to the increased requirements with rating and "wings" awarding. Figure 1 below details all of the different simulation events students experience throughout the syllabus. Note the difference between the emphasis on air-to-air or air-to-ground controller concepts, which is more in line with traditional weapons director responsibilities, such as tactical intercept simulation or air to surface simulation and the heavy emphasis on large force employment simulation.

Mission	Hours
Flight Simulator (FS-1–5)	6.0
Data Link Console Familiarization (LS-1)	3.0
Tracking Simulation (TS-1–3)	12.0
Cutoff Intercept Simulation (CO-1–7)	38.0
Stern Intercept Simulation (STERN-1–3)	18.0
Air Refueling Simulation (AR-1–4)	24.0
Air to Surface Simulation (AS-1–4)	38.0
Tactical Mission Simulation (TAC SIM-1–3)	18.0
Air Combat Maneuvering Simulation (ACM-1)	6.0
Tactical Intercept Simulation (TI-1–8)	48.0
Air Combat Tactics Simulation (ACT-1–4)	24.0
Large Force Employment Simulation (LFE-1–12)	120.0
High Performance Simulation (HPS-1–2)	12.0
Total	**367.0**

Figure 1. Undergraduate Air Battle Manager Simulator Training [xxiv]

Simulations make up 367 of 1,529 (24%) syllabus hours which is 10% less hours than the 1996 *Battle Manager Syllabus* (431 syllabus hours) however the decrease in live control opportunities must also be noted in order to understand this figure within the context of decreasing opportunity to develop critical ABM skills. "Think of the game Connect-4 where you drop tokens down a column or across rows. 10-12 years ago, ABMs were really good at air-to-air control and maxed out one column of the Connect-4 game. Over the years, the

tokens were re-distributed from air-to-air control across other columns (representing different tasks). Add in a decrease in training hours over the 10-12 years implies fewer tokens to distribute in the Connect-4 game and an overall decrease in quality."[xxv] Study of the 2013 and 1996 syllabus for live control opportunities shows a decrease of 65% in the course of 17 years. This decrease was not mitigated by the 10% increase in simulator usage. In the 1996 syllabus, one-to-one cutoff and stern "bumpheads" can be conducted in live or simulation. One can assume at least 50% of those missions would have been completed using live aircraft however based on three F-15C training squadrons who had to complete that phase of their syllabus. Adjusting for that fact there would be a decrease of 53% of live control from 1996 to 2013.

Mission (Control)	Hours
AG-1	8.0
AG-2	8.0
AG-3	8.0
TAC-1	6.0
TAC-2	6.0
TAC-3	6.0
TAC-4	6.0
TAC-5	6.0
HP-1	8.0
HP-2	8.0
HP-3	8.0
HP-4	8.0
Totals	**96.0**

Figure 2. Live Control Events (2013 Syllabus) [xxvi]

Missions (Control)	
Sim/Live One-on-One Cutoff and Stern Bumpheads	140
Tactical Engagements	134
Totals	**274**

Figure 3. Live Control Events (1996 Syllabus) [xxvii]

A note in the 2013 syllabus allows for two of the four high performance (HP) missions to substitute FMT missions for HP due to lack of availability of live assets. If that

option were exercised, the UABMT student would have 80 hours of live aircraft control, or a decrease of 71%, from 1996 to 2013. Due to the Air Force's inability to provide adequate live training venues and the general unsuitability of a UABMT student to control large quantities of aircraft the undergraduate air battle manager syllabus understandably had to move to a more simulated environment.

Background: Education and Learning Philosophy

According to Bloom's Taxonmy, "there are three domains of educational activities or learning: cognitive, affective, and psychomotor." [xxviii] Most instructional designers, trainers, and teachers separate these three domains into the acronym KSA or Knowledge, Skills, and Attitudes. The first two are the most important for the study of ABM training and using live or simulated aircraft and scenarios. Knowledge deals with cognitive abilities, or mental skills, required in order to be successful at a given task. Both the 1996 and 2013 syllabus provides academics before moving on to any type of live or simulated event. Skills deals with psychomotor, or learning by doing. In the context of the ABM syllabi this is when students are actually controlling live or simulated aircraft and using the software. The syllabus flow for 1996 and 2013 follows Bloom's taxonomy exactly in that there are academics, followed by a test, and then UABMT students are provided the opportunity to practice the skills they have academically learned.

Inside the cognitive domain, or knowledge, there are six separate categories: knowledge, comprehension, application, analysis, synthesis, and evaluation.[xxix] Through the course of the academics UABMT students achieve knowledge and comprehension validated through the use of examinations. The rest of the categories are exercised during the simulated or live control events. Knowledge deals with simple recall of data or information; academic

test questions such as “What is the mission of the F-22A?” serves as an excellent example. Comprehension is understanding the meaning of a problem or to be able to translate into the student’s own words; for example a test question asking a student to give an example of an aircraft that performs the defensive counter air (DCA) mission. Application means to use a concept in a new way such as when the student is controlling live or simulated aircraft and has to take a concept, threat calls to an untargeted air-to-air adversary aircraft, and apply that to a defended point during DCA. Analysis means to split concepts into parts and understand the structure. The UABMT student demonstrates analysis by applying when to make a threat to striker call based on multiple briefed criteria such as: adversary aircraft inside of 30 Nautical Miles (NM), unengaged by friendly fighters, and an unimpeded attack axis to friendly bombers. Synthesis and evaluation are both demonstrated during the large force employment section of training where the students are responsible for taking all of the control concepts they learned until that point and providing a step brief for their “crew” with an emphasis on contracts and information passage.

ANALYSIS, CONCLUSION, AND RECOMMENDATION

Analysis

A review of the 1996 and 2013 syllabus it is easy to see that the ABM syllabus has lost a significant portion of the “psychomotor” learning Bloom felt was critical to improving student learning and skill retention. The drastic reduction of live control events, coupled with the slightly increased simulator control missions, does not provide adequate learning opportunities for the UABMT student. Anecdotally, the previous generation always thinks that the current generation is less prepared and more inexperienced than they were at similar points in their career development. In this case, the previous generation would be correct

based on an 84% reduction, from 1996 to 2013, of live fighter control opportunities. Assuming simulated control is exactly the same as live control that number drops to 74%. In either case, ABMs have fewer opportunities to practice their basic craft, control, during their initial skills training.

Combat Air Weapons Officer Analysis

A study of a six AWACS deployment crews to South West Asia (SWA) supporting Operation INHERENT RESOLVE, in the fall of 2015, allows for an analysis of the effectiveness of the 2013 syllabus. An AWACS "combat crew" is comprised of four Air Weapons Officers (AWOs), the initial ABM qualification held by graduates of UABMT. To note, the AWOs have also been through AWACS initial qualification training, mission qualification training, and deployment preparation training. This is an additional 140 to 180 days of training, on top of the 190 training days allocated for UABMT, to increase their skills. Roughly 80% of the AWOs were graduates of the 2013 *Undergraduate Air Battle Manager Syllabus* and the remaining 20% were produced under the 2015 syllabus.

On the combat crews there are four primary AWO positions: Area of Operations (AOR) AWO, Close Air Support (CAS) AWO, Tanker AWO, and tactical chat AWO (Chat).

First the AOR AWO is the "voice" of AWACS in the AOR; he or she is responsible for all voice communications on and off board AWACS to tactical (fighter/bomber/tanker) aircraft. Second, a CAS AWO is responsible for controlling dedicated strike packages into the AOR. Third, the Tanker AWO is responsible for managing quantity of fuel and number of tankers in the AOR to ensure there is enough fuel for all scheduled receivers. Finally, the Chat AWO is responsible for data entry and for deconflicting airspace for Remotely Piloted

Aircraft (RPA). The hierarchy of controllers, based on skill required and complexity of mission, is: AOR, Tanker, CAS/Stirke, and finally Chat.

All six AOR controllers were produced under the 2013 syllabus and in interviews with their immediate on the aircraft supervisors their universal strengths were their ability to "react quickly and CORRECTLY to non-standard situations"[xxx] and to "think on their feet." When the AOR controllers were questioned about their abilities they mentioned complex live exercises such as NORTHERN EDGE and RED FLAG-Nellis allowed them to perform at a higher level than their peers. None of the six AOR controllers mentioned the four dedicated spin up DMOs, executed with DTOC support, designed to replicate their current theater as helping or hurting their spin up preparations. In order to successfully execute the most dynamic AWO position on the jet, more live training was required.

The second most dynamic position on the crew was Tanker AWO, or more commonly called "tank." The "tank" controller is responsible for running the fuel management timeline for the AOR controller ensuring current and future fuel needs of the AOR are met. Some crews allowed their "tank" controller to communicate on the primary frequencies when discussing changes, additions, or deletions of aerial refueling. This controller works closely with Air Operations Center (AOC) personnel to ensure refueling needs are met. When asked about training that prepared the "tank" controller for their combat duties, their primary response were on-the-job-training (OJT).[xxxi] Their responses were that "simulations and DMOs were never long enough to see impacts of mistakes" or that "exercises periods were so short that the tanker plan pretty much executed itself." Several of the "tank" AWOs responded that they thought the spin up DMOs were "negative" training because their mistakes were never brought out due to lack of time or drivers.[xxxii] Five of six

"tank" AWOs were graduates of the 2013 syllabus but required "live" training to get them to a point where they could perform their duties efficiently.

Third in line was the CAS AWO or more commonly called "strike"; "strike" was responsible for controlling dedicated strike missions in the AOR but also the primary assistant to the AOR and "tank" controller. He or she was also responsible for taking over AORs radios and responsibilities when they had to leave to use the restroom over the course of lengthy sorties. When asked what prepared them to execute in this role in combat, the CAS AWOs again responded with "complex live exercises."[xxxiii] Three of six CAS AWOs were graduates of the 2013 syllabus and the other three were products of the more recent 2015 Undergraduate Air Battle Manager syllabus.

Finally, the "chat" AWO was typically the most inexperienced AWO on the AWACS. Due to the physical proximity to their frontline supervisor, the senior director (SD), this AWO could be more closely controlled and monitored. When the six combat SDs were polled the experience level of the "chat" AWO was not as important because "I can physically read what they type and correct it before they hit 'enter.'"[xxxiv] On five of six combat crews this AWO was the most recent graduate of UABMT and had only participated in minimal (syllabus) live training. When reviewing the previous and subsequent AWACS combat crews a similar personnel distribution was observed; for the better part of a year (2015) the personnel with the most live training were put into the most challenging Air Weapons Officer position.

A common theme, regardless of position, is that the simulations did not prepare the AWO for the tasks they were asked to accomplish in combat. The DMO the crews were presented with was a "snapshot" of warfare from approximately two months prior to the

squadron's deployment. The adversary tactics and locations, friendly tactics and locations, and many of the other details were accurate at the time simulation inputs were ended. This is due to having to build pilot scripts, computer models, electronic warfare information, training for the DTOC operators, and many other details dealing with Air Force contracting. The amount that warfare changes in two months can be significant especially for an ABM who is required to translate commander's intent. A more realistic simulation will require the use of a more realistic script but when the average AOR AWO makes approximately 2,000 radio transmissions to approximately 100 aircraft a comprehensive script is impossible to develop. The script already includes the desired learning objectives for that simulation but anything beyond those scripted inputs is at the discretion of the simulated "pilot" and has the potential to drive false learning.

The spin-up DMOs were approximately one to one-and-a-half hours long with brief and debrief time allotted. More simulator time was not available due to other user, both DTOC and AWACS simulator, requirements. This is a function of the amount of training that must be accomplished in the simulators for all AWACS crews regardless of deployment or mobilization status. In order to develop more realistic simulations the simulation run time must be more representative of an a combat sortie; two to three hours would allow the crews to see and interact with their simulated environment and the time would allow mistakes to compound and drive more learning.

Parallels to Undergraduate Air Battle Manger Training

The difficulties of spinning up an AWACS squadron for combat in Operation INHERENT RESOLVE is directly linked to the increasing usage of simulation in UABMT syllabus. Using live radar, radios, pilots, WSOs, and AOC personnel injects a unique blend

of confusion and situational awareness that cannot be captured with a script. The average UABMT instructor has: 5-7 years of commissioned service with 4-6 years as an ABM, 2-3 deployments, and 3-4 “major” live exercises. Based on those credentials one would assume that a comprehensive script could be generated that would allow for a more “realistic” simulation and eliminate “simisms.” The issue is that simulation development is not a formalized course taught to any UABMT instructor nor is it their primary duty. Updated simulation scripts are more “evolutionary” than they are “revolutionary” due to the fact that they are created by one instructor, or perhaps collaboration among several instructors, that fails to take into account many of the possible outcomes of one action. Additionally, the UABMT instructor is writing scripted inputs for personnel, aircraft, and positions that they are simply not qualified; for example, if an UABMT instructor never held a qualification in the aircraft they will provide communications and tactics examples based on what they have personally observed that aircraft do in combat or training. This simulation script will be provided to the PS (1C5 AFSC) and executed as written. This leads to particularly egregious errors in tactical application of specific combat principles and the UABMT student to take false learning from the simulation.

Application of Civilian Flight Training Principles

The FAA experienced significant pushback when they increased the amount of hours a pilot candidate could log, to seek an instrument rating up to 40%. The 2013 *Undergraduate Air Battle Manager Syllabus* has 24% of its syllabus hours accounted for using simulator based[xxxv] control. However, in the context of total control opportunities that number increases to 80% of controller opportunities is simulator based. Applying the same logic used by opponents of the FAA increased allowance for simulator hours in instrument training

UABMT students have been provided with significantly less of an opportunity to succeed. Additionally, ATC operators are not permitted to do any of their training in simulators and are bound by Federal Code, in Title 14 Part 65, to conduct only live "training" to maintain their rating. As the closest "cousin" to civilian ABM the FAA has deemed that simulators can not be used to replace live training events.

When describing the expectations of an UABMT graduate according to Major John Ohlund, former Squadron Weapons Officer and instructor at the 8th Weapons Squadron at Nellis AFB. "The ABM career field faces a quality versus quantity conundrum. Over the past 10-12 years, the tasks expected of ABMs increased. Gone are the days of air-to-air control experts and now are the days of battle management expectations. Today, ABMs are more aware of the CFACC tasks and expectations; however, lack the quantity of in-depth training events in each task and expectation."[xxxvi] Due to a continual decrease in funding live training opportunities are unlikely to increase in the near future so ABM training must then move to more simulator based training in order to compensate. This is reflected in the evolution of the 2013 syllabus to the 1996 syllabus. Regarding the "lack of quantity of in-depth training events" when asked about whether Major Ohlund thought ABM training could and/or should be conducted solely using simulators his response was "Yes. Anything is possible with the proper budget, proper authors and drivers, sufficient equipment, and the best instructors. Each of the aforementioned is underwhelming and does not allow today's training of ABMs to be solely effective through simulators."[xxxvii]

Conclusion

The nature of the problem included: decreasing live control opportunities that drove a lack of ABM ability to make decisions with less than perfect information, lack of quality

scripts and drivers for simulations, and lack of clarity on the scope of ABM responsibility. The relatively rapid decline of live training opportunities, in addition to increased responsibilities, has led to less capable ABMs entering the CAF. Through squadron continuation training, training plans, and careful management of junior ABMs by their more senior counterparts the effects of a less capable UABMT graduate have been mitigated. However, with the push to decrease the number of crewmembers in AWACS, JSTARS, and the CRC via upgrades in computing power and software the ability to mitigate quality training with quantity of people is drawing to a close. Finally, the decrease of rapid decrease of live training and relatively static nature of training has not produced ABMs who were adequately prepared to attain mission ready status at their follow on assignments without significant top off training.

In order to address the decreasing live control opportunities simulations must increase in quality as well as quantity. To affect this change will require the cadre at the 337th ACS to engage in a thorough review of all current simulations to ensure they are producing UABMT graduates who hold the required skills to become mission ready in their next platform. The simulations will need to reflect the full spectrum of warfare that graduates are entering in 2016 as well as prepare them for future conflicts. An increased emphasis on fundamental battle management tasks and less emphasis on control will be a natural by product of this simulation analysis.

To ensure the UABMT scope of training is correctly aligned with CAF requirements to become mission ready each subsequent syllabus should be fully reviewed by subject matter experts from each of the three primary combat platforms (AWACS, JSTARS, and CRC) as well as experts from air operations centers. This syllabus review, from experts, will

easily allow gaps in capabilities of graduates to be indentified and improved before UABMT graduates become mission ready in a combat squadron.

Recommendation

To account for the significant decline in live control opportunities the cadre at the 337th ACS must acknowledge they will require external assistance in two areas in order to produce effective simulations. Simulator execution assistance is readily available with DTOC and FMT assistance and using pilot simulators for the more basic, easily scripted tasks. Repurposing several of the civilian contractors to simulation design, on an as needed basis, will help alleviate demands on instructor time. In order to increase the quality of the simulators a cadre of contractors, preferably from several different aircraft or mission sets, would increase the quality of responses and increase the realism of UABMT training. This concept has/is already been implemented in the FMT block of instruction. The "pilots" are all former F-15C, F-16, or F/A-18 pilots. On end of course reviews and from instructor feedback this block of training consistently receives the highest marks for realism and applicability.

A through review of each syllabus by experts from AWACS, JSTARS, and CRCs as well as air operations center personnel will ensure graduates of UABMT will have the foundational skills to battle manage regardless of platform. This happens to a limited degree but those who come to review the syllabus are typically recent graduates who lack the experience necessary to reflect on the efficacy of training. Therefore, recommend that minimum required attendees from each weapons system be a combination of one Squadron Commander, one squadron Director of Operations, and one Weapons Officer. These attendees would preferably be recent deployed returnees and this could easily be accomplished with a series of video teleconferences or a short temporary duty assignment to

the 337th ACS. Additionally, AOC representation would ideally include Senior Air Defense Officer, Command and Control Director of Operations (C2DO), Combat Plans, and Chief of Combat Operations. Ideally, these would be spread between PACOM and CENTCOM AOC personnel to ensure current and future war fighter requirements are met.

An UABMT syllabus for 2025 must acknowledge that ABM skills and competencies must continue their evolution beyond basic air-to-air control.

> "The perennial emphasis on live fighter control for ABM training is archaic. Fighter pilots create 2v2 or 4v4 scenarios as a part task trainer for their large force employment scenarios. Controller-related tasks are sufficiently covered by said 2v2 and 4v4 scenarios. Fighter pilot training culminates with LFE training and combat employment. Controller training also culminates with an LFE. However, a fighter pilot is not expected nor tasked to conduct theater-wide battle management. Accordingly, an ABM uses an LFE as a part task trainer to prepare for theater-wide combat employment. ABM training is deficient of available live LFE opportunities and must be supplemented with effective simulator events."[xxxviii]

Additionally, as the 337th ACS now awards wings basic aviation principles must continue to be instructed to ensure a well rounded aviator. This syllabus will consist of six blocks covering basic battle manager responsibilities regardless of future C2 platform. In this respect, graduates of the 2025 Syllabus will be prepared to enter follow on training for AWACS, JSTARS, CRC, or ADS with minimal crew and equipment training.

I. Block I: Introduction to Aviation
II. Block II: Fundamentals of Control
III. Block III: Fundamentals of Battle Management
IV. Block IV: Small Force Employment
V. Block V: Large Force Employment
VI. Block VI: Theater Employment

In Block I, UABMT students will learn basic aviation fundamentals; their course will include one of two options. The first option will be to attend Introductory Flight Training (IFT) at Pueblo, Colorado with future pilot and combat systems operators students to ensure a common baseline of knowledge amongst all rated aviators as they enter their specific

training pipeline. If this option is not available 337th ACS instructors, using Mu-2 aircraft currently under contract, will use a similar training methodology and scope. IFT focuses on aviation fundamental principles i.e. relationship between thrust, lift, drag, classes of airspace, and aeronautical navigation. As aircrew, UABMT graduates need to have an understanding of basic aviation to ensure they are able to effectively integrate as part of a flying squadron. This block of training will use primarily live fly aircraft provided by a civilian contractor.

In Block II, the students will learn basic fundamentals of control; specifically they will be broken down by the continuum of control: close, tactical, broadcast, advisory, and autonomous. Using 3-1.1 and Air, Land, and Sea (ALSA) publications UABMT students will learn how to communicate with Joint partners to ensure maximum interoperability between services. Additionally, they will learn principles associated with each type of control and how to affect intercepts with each; while traditionally instructed in an air-to-air mindset each of these types of control can be adapted to an air-to-ground arena as well. This section will consist primarily of academics combined with live control opportunities using Mu-2 aircraft to simulate high performance aircraft.

In Block III, Fundamentals of Battle Management, UABMT students will learn how to execute the range of C2 functions from Combat Air Patrol manning to integration of non-kinetic effects. In this block, student will be given basic tools using mission areas such as Defensive Counter Air, Offensive Counter Air, Dynamic Targeting, and Personnel Recovery. This phase will consist primarily of academics with simulations to reinforce simulations.

Block IV, Small Force Employment, will teach students the basics of integration across multiple mission sets. For example, defensive counter air will include integration with air defense artillery in addition to a four ship of air-to-air fighters. This block of instruction

will primarily be run through DTOC with the option to replace DMO with live control if the missions are available.

Block V, Large Force Employment, will teach students how ABMs integrate into the larger construct similar to a RED FLAG type scenario. Again, aligned with the five mission areas students will be provided the opportunity to integrate ABM into a larger construct. This block of training will be academic and DMO based to control learning objectives for each event. There will be no Air Operations Center interaction to limit the scope of this block.

Block VI, Theater Employment, will provide UABMT students to examine how a smaller AOR fits into a larger campaign. This will include extensive academics on Air Operations Center employment as well as roles and responsibilities of different actors in the Theater Air Control System (TACS). It will end with the student's capstone exercise where they plan and execute a theater campaign plan.

This syllabus expands on General Mark Welsh's comments at Weapons and Tactics Conference (WEPTAC) 2012 "We're going to have to do the 2v2 and 4v4s in the live environment and the more complex 'stuff' in the DMO because we just can't afford to fly it or don't have the aircraft available to generate that many sorties." [xxxix] The emphasis for live control opportunities will be in the earlier syllabus rides because the numbers of assets required to generate adequate ABM learning outcomes will be greater and could adversely affect other platforms learning objectives.

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[viii] Unknown. Electronic Code of Federal Regulations Title 14, Chapter I, Subchapter D, Part 63. 14 March 2016.

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[x] Unknown. Electronic Code of Federal Regulations Title 14, Chapter I, Subchapter H, Part 65. 14 March 2016.

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[xxxii] *Ibid.*

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Appendix A: 2025 UABMT Syllabus

I: Block I - Introduction to Aviation
- A. Basic Flight Principles
  - a. Academic/Simulator
- B. Airfield Navigation/Safety
  - a. Academic/Practical
- C. Ground Operations
  - a. Academic/Simulator
- D. Taxi/Departure Procedures
  - a. Academic/Simulator/Live Flight
- E. Basic Aeronautical Navigation
  - a. Academic

F. Airspaces
    a. Academic
G. General Aviation Communications
    a. Academic/Simulator

II. Block II – Fundamentals of Control
A. 3-1.1 General Planning: Communication Fundamentals
    a. Academic
B. Air Land Sea Brevity Terminology
    a. Academic
C. Joint Publication 3-09.3 Communication
    a. Academic
D. Continuum of Control
    a. Academic
E. Radar Theory
    a. Academic
F. Communications Theory
    a. Academic
G. Passive Detection Theory
    a. Academic
H. Non-Kinetic Theory
    a. Academics
I. Air-to-air Threats
    a. Academics
J. Surface-to-Air Threats
    a. Academics
K. Non-Kinetic Threats
    a. Academics
L. Base Defense Threats
    a. Academics
M. Stern Intercepts
    a. Simulator
N. Cutoff Intercepts
    a. Simulator
O. Close Control Aerial Refueling
    a. Simulator
P. Tactical Intercepts
    a. Simulator/Live (Mu-2)
Q. Air to Ground Intercepts
    a. Simulator/Live (Mu-2)
R. Surveillance Voice Tell
    a. Simulator/Live
S. Electronic Warfare Communications
    a. Simulator

III. Block III - Fundamentals of Battle Management
A. Defensive Counter Air
    a. Force Accountability

i. Academics
b. Combat Air Patrol Manning
i. Academics
c. Tanker Management
i. Academics
d. War Reserve Materials Management
i. Academics
e. Integration of Non-Kinetic Effects
i. Academics
f. Ground Based Air Defense Integration
i. Academics
g. Surveillance and Identification
i. Academics
h. Air Operations Center Information Requirements
i. Academics

B. Offensive Counter Air
a. Force Accountability
i. Academics
b. Basic Weaponeering
i. Academics
c. Ground based fires integration
i. Academics
d. Air Operations Center Information Requirements
i. Academics
e. Dynamic Target Management
i. Academics
f. Ground Surveillance and Reporting
i. Academics
g. Integration of Non-Kinetic effects
i. Academics
h. Electronic Warfare Integration
i. Academics

C. Dynamic Targeting
a. Force Accountability
i. Academics
b. Target prioritization and allocation
i. Academics
c. Sensor and Data Fusion to produce targets
i. Academics
d. Integration of Non-Kinetics
i. Academics
e. Electronic Warfare Integration
i. Academics

D. Combat Search and Rescue
a. Force Accountability
i. Academics

b. CSAR Equipment and Integration
    i. Academic
c. CSAR Tactics
    i. Academic
d. Preplanned CSAR
    i. Academics
e. Reactive CSAR
    i. Academics

IV. Block IV - Small Force Employment

A. Defensive Counter Air: This section will then allow students to apply the academics from Block III: Defensive Counter Air in small scale vignettes.
B. Offensive Counter Air: This section will allow students to apply the academics they learned in Block III: Offensive Counter Air in small scale vignettes.
C. Dynamic Targeting: This section will allow students to apply the academics they learned in Block III: Dynamic Targeting
D. Combat Search and Rescue: This section will allow students to apply the academics they learned in Block III: CSAR

V. Block V - Large Force Employment

A. This section will combine two mission areas such as Offensive Counter Air and CSAR or Offensive Counter Air and Dynamic Targeting.

VI. Block VI - Theater Employment

A. This section will focus on integrating all mission areas into a lengthy simulation while adding AOC integration.